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Original Research Article

Obstetric factors associated with cesarean section: a retrospective study of 1,485 births in Southern Brazil

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ABSTRACT

Background: Cesarean rates have risen globally beyond recommended levels, without consistent improvements in maternal and neonatal outcomes. In Brazil, high rates persist despite policies promoting evidence-based, humanized care, with limited adherence in practice. This study aimed to identify factors associated with delivery mode in a hospital in southern Brazil to support vaginal birth and align practices with current recommendations.
Methods: A retrospective, descriptive, cross-sectional quantitative study was conducted based on the analysis of 1,485 medical records of parturients assisted through the Brazilian Unified Health System (SUS) who underwent vaginal or cesarean delivery between 2019 and 2021, in a hospital institution in Rio Grande do Sul, Brazil. Maternal characteristics, clinical conditions, and obstetric practices were assessed. Logistic regression analysis was performed to estimate odds ratios (ORs) and identify variables associated with mode of delivery.
Results: Among the 1,485 medical records of parturients, 47.9% had a vaginal birth and 52.1% underwent a cesarean section. Primiparity, absence of cervical dilation upon admission, absence of desire for vaginal delivery, non-performance of amniotomy, administration of oxytocin, as well as non-pharmacological measures were significantly associated with a greater likelihood of cesarean section. Primiparous women were more likely to undergo a cesarean section (OR=2.97), while advanced cervical dilation (7-10 cm) markedly reduced the odds of cesarean delivery (OR=0.03). Maternal preference for vaginal birth, amniotomy, and the use of non-pharmacological measures were also protective factors against cesarean section.
Conclusions: In conclusion, cesarean delivery is influenced by modifiable clinical and care-related factors, highlighting opportunities to reduce unnecessary interventions. Promoting evidence-based, woman-centered practices may contribute to increasing vaginal birth rates and improving maternal and neonatal outcomes.

Keywords: Caesarean section, Vaginal birth, Obstetric factors, Obstetric interventions, Unified health system

INTRODUCTION

Since 1985, the international medical community has considered an optimal cesarean section rate to be between 10% and 15% of all births, based on data from Northern European countries reporting excellent maternal and perinatal outcomes.[1] In recent decades, however, cesarean delivery rates have risen sharply across both developed and developing nations.[1,2] This increase reflects a combination of social, cultural, and institutional factors, including maternal preference, fear of labor pain, and scheduling convenience.[3] Despite notable advances in obstetric care, maternal and infant morbidity and mortality remain high in Brazil, revealing a paradox in which increased medical technology does not necessarily translate into better outcomes.[4] The World Health

Organization (WHO) has stressed that cesarean rates should not be treated as targets but rather as the result of providing surgery only when clinically warranted.[1] Global estimates show that the proportion of cesarean births rose from 7% in 1990 to 21% in 2018 and is projected to reach nearly one-third of all deliveries by 2030.[3] Moreover, international studies reveal wide inequalities: high-income regions often show excessive use, whereas in other areas insufficient access to cesarean delivery can put lives at risk.[5,6]

In Brazil, the Ministry of Health has implemented several evidence-based policies, including the National Guidelines for Normal Childbirth Care and the National Policy for the Humanization of Childbirth and Birth, to encourage and protect vaginal birth. Nevertheless, adherence to these recommended practices remains limited.[2,4,8,9.]

According to the *"Birth in Brazil"* survey, only 5.6% of vaginal births occur without intervention, and outdated procedures such as the Kristeller maneuver remain in use.[9] Although progress has been made toward more humanized, evidence-based childbirth care, further efforts are needed to strengthen the implementation of national recommendations and better understand the factors influencing delivery mode in different clinical settings. This study therefore aimed to identify the factors associated with delivery mode in a hospital in Rio Grande do Sul, Brazil, with the goal of promoting vaginal birth, reducing unnecessary interventions, and aligning practices with national and international recommendations.

METHODS

A retrospective, descriptive, documentary, cross-sectional study with a quantitative approach was conducted. Medical records of women in labor who delivered vaginally or by cesarean section were analyzed. All participants were users of the Brazilian Unified Health System (Sistema Único de Saúde – SUS) and were admitted to the Obstetric Center (OC) of a hospital in Rio Grande do Sul, Brazil, a referral institution serving the 16th Regional Health Coordination (16ª CRS), which covers 325,412 inhabitants across 37 municipalities.

The sample consisted of electronic medical records from women assisted through the SUS, who were admitted to the OC in labor and underwent vaginal or cesarean delivery between 2019 and 2021. Medical records with incomplete data were excluded. The study period was selected to assess adherence to the updated WHO recommendations on intrapartum and childbirth care published in 2018.

Data were collected using a standardized form, and 1,485 medical records of parturients were reviewed through the Tasy electronic health system used in the OC. The following variables were evaluated: parity, cervical dilation, uterine dynamics, integrity of the amniotic sac, pregnancy classification (low or high risk), number of prenatal consultations, maternal preference for delivery mode, exercises performed during labor, use of non-pharmacological measures (hydrotherapy, aromatherapy, massage, dim lighting, and freedom of movement), presence of a companion, amniotomy, use of oxytocin or misoprostol, mode of delivery, episiotomy, episiorrhaphy, indications for cesarean section, skin-to-skin contact and breastfeeding within the first hour of life, and maternal or neonatal complications. Data was compiled onto a password-protected spreadsheet accessible only to the researcher. No identifying information related to patients, professionals, or the hospital was included.

Statistical analyses were conducted using R software. Estimates were presented as proportions (%) with corresponding 95% confidence intervals (95% CI). A logistic regression model, implemented via the glm function, was used to evaluate the association between predictor variables (maternal characteristics and clinical conditions) and response variables (delivery mode, cesarean section or vaginal birth). Multicollinearity among predictors was assessed using the Variance Inflation Factor (VIF) to ensure the validity of estimated coefficients. Variables with VIF values greater than 10 were considered collinear and therefore removed or transformed.

Odds ratios (ORs) with corresponding CIs and statistical significance levels were used to interpret the final model. The analysis focused on interpreting the significant variables influencing the likelihood of cesarean section or vaginal birth, adjusting for potential confounders. Automated variable selection was performed using the stepAIC function based on the Akaike Information Criterion (AIC) to optimize model performance, identifying the subset of predictors that best explained the occurrence of cesarean or vaginal delivery while penalizing model complexity.

The study was approved by the Research Ethics Committee (COEP) of the University of Vale do Taquari – Univates (CAAE: 61171322.5.0000.5310; approval number: 5.601.075).

RESULTS

A total of 1,485 medical records of parturients were included in the analysis. The mean maternal age was 28.1 years. Most women self-identified as White (80.8%). Regarding obstetric characteristics, the mean number of prenatal visits was 11.2. The majority of women were multigravidas (61.3%), and 80% of pregnancies were classified as low risk. At the time of hospital admission, uterine contractions were present in 69.8% of parturients, and 44.6% had no cervical dilation.

Approximately half presented with ruptured membranes (52.1%), while 68.7% had no amniotic fluid leakage; when present, the fluid was most often clear in appearance (21.9%). During hospitalization, 60.1% of women did not express a preference for vaginal delivery.

Amniotomy was performed in 15.6% of cases, and misoprostol was administered in 14.5% of the sample. Non-pharmacological pain relief methods—such as hydrotherapy, use of a birthing ball, physical exercises, and aromatherapy—were employed in 50.8% of deliveries. Clinical or obstetric complications were recorded in 2.6% of cases (Table 1).

Table 1: Sociodemographic and obstetric profile of parturients, 2019–2021 (n=1,485).

Variables	N (%)
Sociodemographic	
Age*	28.1±6.66
Ethnicity	
White	1,200 (80.9)
Black	141 (9.6)
Indigenous	3 (0.2)
Asian	1 (0.1)
Brown	138 (9.3)
Obstetric Primigravida	
No	909 (61.3)
Yes	574 (38.7)
Uterine dynamics	
Absent	444 (30.2)
Present	1,027 (69.8)
Cervical dilation	
Absent	635 (44.6)
1–3 cm	292 (20.5)
4–6 cm	268 (18.8)
7–10 cm	230 (16.1)
Membrane integrity	
Intact	109 (48)
Ruptured	769 (52.1)
Amniotic fluid loss	
No	1,016 (68.7)
Yes	462 (31.2)
Amniotic fluid appearance	
Not applicable / absent	1,023 (70.3)
Clear	318 (21.9)
Meconium-stained	42 (2.8)
Clear with particles	12 (0.8)
Bloody	55 (3.8)
Other	6 (0.4)
Pregnancy risk classification	
High risk	297 (20)
Usual risk	1,188 (80)
Number of prenatal consultations*	11.2 (± 4.24)
Expressed preference for vaginal birth	
No	884 (60.1)
Yes	587 (39.9)
Amniotomy	
No	1,253 (84.4)
Yes	232 (15.6)
Use of non-pharmacological measures	
No	730 (49.2)
Yes	755 (50.8)
Use of oxytocin	
No	1,004 (67.6)
Yes	481 (32.4)
Use of misoprostol	
No	1,270 (85.5)

Continued.

Variables	N (%)
Yes	215 (14.5)
Episiotomy	
No	1,315 (88.6)
Yes	170 (11.4)
Clinical or obstetric complications	
No	1,447 (97.4)
Yes	38 (2.6)

Note: *Mean (standard deviation).

Table 2: Factors associated with mode of delivery, 2019–2021.

	Mode of delivery		Crude model		
	Vaginal N (%)	**Cesarean N (%)**	**OR**	**VIF**	**P value**
Primigravida					
No	419 (28.3)	315 (21.4)	4.00	1.49	
Yes	284 (19.2)	460 (31.3)			<0.001
Uterine dynamics					
Absent	129 (8.8)	315 (21.4)		1.44	
Present	567 (38.5)	460 (31.3)	0.62		0.098
Cervical dilation					
Absent	64 (4.5)	571 (40.1)	-		-
1–3 cm	188 (13.2)	104 (7.3)	0.13	2.08	<0.001
4–6 cm	198 (13.9)	70 (4.9)	0.12		<0.001
7–10 cm	204 (14.3)	26 (1.8)	0.03		<0.001
Membrane integrity					
Intact	370 (25)	339 (22.9)		1.27	-
Ruptured	331 (22.4)	438 (29,7)	1.30		0.271
Amniotic fluid loss					
No	395 (26.7)	621 (42)	0	76.34	
Yes	307 (20.8)	155 (10.5)	0		0.999
Pregnancy risk classification					
High risk	102 (6.9)	195 (13.1)		1.31	
Usual risk	602 (40.5)	586 (39.5)	1.09		0.771
Expressed preference for vaginal birth					
No	239 (16.2)	645 (43.8)	0.11	1.53	<0.001
Yes	453 (30.8)	134 (9.1)			
Amniotomy					
No	488 (32.9)	765 (51.5)	0.059	1.25	<0.001
Yes	216 (14.5)	16 (1.1)			
Use of non-pharmacological measures					
No	137 (9.2)	593 (39.9)	0.358	1.56	<0.001
Yes	567 (38.2)	188 (12.7)			
Use of oxytocin					
No	313 (21.)	691 (46.5)	0.321	1.24	<0.001
Yes	391 (26.3)	90 (6.1)			
Use of misoprostol					
No	577 (38.9)	693 (46.7)	0.777	1.48	0.404
Yes	127 (8.6)	88 (5.9)			
Episiotomy					
No	535 (36)	780 (52.5)	4755	12.73	0.999
Yes	169 (11.4)	1 (0.1)			
Clinical or obstetric complications					
No	692 (46.6)	755 (50.8)	0.003	1.13	<0.001
Yes	12 (0.8)	26 (1.8)			

Note: 95% CI - Confidence Interval; OR - Odds Ratio; p-values in bold indicate statistical significance.

Table 3: Adjusted model on the influence of obstetric variables on obstetric interventions and mode of delivery 2019–2021.

	OR	95% CI	P value
Primiparous	2.97	2.31 – 4.52	<0.001
Uterine dynamics present	0.503	0.31 – 0.82	<0.001
Cervical dilation 1–3 cm	0.118	0.07 – 0.20	<0.001
Cervical dilation 4–6 cm	0.134	0.08 – 0.23	<0.001
Cervical dilation 7–10 cm	0.030	0.02 – 0.06	<0.001
Preference for vaginal birth	0.178	0.11 – 0.27	<0.001
Amniotomy	0.104	0.05 – 0.20	<0.001
Use of non-pharmacological methods	0.389	0.24 – 0.62	<0.001
Use of oxytocin	0.344	0.22 – 0.52	<0.001
Clinical or obstetric complications	0.008	0.0004 – 0.04	<0.001

Regarding the delivery outcomes, 47.9% of women had a vaginal birth, while 52.1% underwent cesarean section. As presented in Table 2, the bivariate analysis identified several variables significantly associated with the mode of the delivery. These included parity, cervical dilation, maternal preference for vaginal birth, amniotomy, use of oxytocin, use of non-pharmacological measures, and the presence of clinical or obstetric complications.

Primiparous women were more likely to undergo cesarean section (OR=4.00, p<0.0001). Conversely, advanced cervical dilation (7–10 cm) significantly decreased the odds of cesarean delivery (OR=0.03, p<0.0001). Maternal preference for vaginal birth also acted as a protective factor against cesarean section (OR=0.11, p<0.0001). Similarly, amniotomy (OR=0.05, p<0.0001), use of non-pharmacological methods for pain management (OR=0.36, p<0.0001), and the administration of oxytocin (OR=0.32, p<0.0001) were all linked to lower odds of cesarean delivery.

Table 3 presents the adjusted model assessing the influence of obstetric variables on the likelihood of obstetric interventions and mode of delivery. After adjustment for confound factors, primiparity continued to be a significant predictor of cesarean section (OR=2.97, 95% CI: 2.31–4.52, p<0.0001). The presence of uterine contractions was associated with a lower likelihood of cesarean delivery (OR=0.50, 95% CI: 0.31–0.82, p<0.0001).

Advanced cervical dilation continued to exhibit a highly protective effect against cesarean section, with dilation of 7–10 cm showing an OR of 0.03 (95% CI: 0.02–0.06, p<0.0001).Maternal preference for vaginal birth (OR=0.17, 95% CI: 0.11–0.27, p<0.0001), performance of amniotomy (OR=0.10, 95% CI: 0.05–0.20, p<0.0001), use of non-pharmacological pain relief measures (OR=0.38, 95% CI: 0.24–0.62, p<0.0001), and administration of oxytocin (OR=0.34, 95% CI: 0.22–0.72, p<0.0001) were also strongly associated with a lower likelihood of cesarean section. Notably, the occurrence of clinical or obstetric complications maintained statistical significance in the model (OR=0.08, 95% CI: 0.004–0.04, p<0.0001).

DISCUSSION

In this study, the occurrence of cesarean delivery was significantly associated with several obstetric and clinical factors. Primiparous women had a higher likelihood of cesarean section, whereas advanced cervical dilation, preference for vaginal birth, amniotomy, and the use of non-pharmacological methods and oxytocin were all independently associated with a reduced likelihood of cesarean delivery.[10] Additionally, the absence of clinical or obstetric complications also contributed to reducing the likelihood of cesarean section.[11]

Consistent with previous findings, primiparity was associated with a markedly increased probability of cesarean delivery.[12] This association has been also reported in international studies, reflecting a trend in which parity consistently emerges as a key determinant of cesarean birth.[12,13] First-time mothers often undergo prolonged and more medically managed labors, increasing the likelihood of surgical interventions, including cesarean sections.[12,13] Cesarean birth among primigravidas may also be influenced by psychological elements such as fear, anxiety, and lack of past experience, factors that appear across diverse cultural and healthcare contexts.[14]

The first pregnancy and childbirth often evoke anxiety and fear, largely due to the absence of lived experience and the influence of social expectations and media narratives. In cultural discourses, labor is frequently portrayed as painful and risky, whereas cesarean section is framed as a safer, more convenient alternative.[15,16] Compounding this perception, inadequate communication and hierarchical relationships between women and healthcare providers can perpetuate misinformation and fear, leading many women to opt for cesarean birth despite an initial preference for vaginal delivery.[16] Evidence indicates that prenatal educational interventions, including birth-preparation groups, can foster maternal autonomy, confidence, and more positive birth experiences.[17]

In the present study, maternal preference for vaginal birth was associated with a significantly lower likelihood of cesarean section.[15] Despite this, the overall cesarean rate remained high (52.1%), consistent with recent findings reported in Southern Brazil and in line with global trends.[3,18] Rasador and Abegg reported that 66.3% of women expressed a preference for vaginal delivery in the beginning of pregnancy, indicating that changes in preference may occur during pregnancy or labor.[18] These findings underscore that decision regarding delivery mode should be based on shared decision-making between healthcare professionals and women, emphasizing informed choice and respect for autonomy.[19] Yet, cultural perceptions regarding the convenience and safety of cesarean birth, as well as providers' clinical training and comfort levels, may continue to influence delivery-related decisions.[19]

Early hospital admission, particularly before the onset of active labor, has been consistently identified as a major contributor to unnecessary cesarean sections and associated adverse outcomes.[10] These include heightened risks of maternal and neonatal morbidity, prolonged hospitalization, infection, postpartum hemorrhage, delayed recovery, and postponed initiation of breastfeeding.[16] Our results corroborate prior evidence indicating that admission during advanced cervical dilation (7–10 cm) is a protective factor against cesarean delivery.[20] Comparable findings have been documented in large multicenter cohorts, demonstrating that timely admission lowers intervention rates and is associated with improved maternal outcomes.[3]

Lower cesarean rates in this study were also associated with amniotomy and the use of oxytocin.[9] As observed by, oxytocin infusion and epidural analgesia tended to be more prevalent among women admitted during the latent phase of labor.[10] According to the National Guidelines for Normal Childbirth Care, early amniotomy whether performed alone or in conjunction with oxytocin infusion should not be routinely applied when labor is progressing normally. Labor acceleration through amniotomy and/or oxytocin contributes to the so-called "cascade of interventions," potentially reducing the likelihood of spontaneous vaginal births.[9] Similarly, excessive and routine use of episiotomy, despite a lack of demonstrated benefit, remains widespread in many healthcare institutions.[9] Evidence from other contexts underscores that early or unnecessary obstetric interventions may elevate surgical delivery rates and compromise perinatal outcomes.[14]

Non-pharmacological methods should be offered from the moment of admission onward to support the physiological progression of labor, enhance maternal satisfaction, and improve perinatal outcomes.[21] These approaches promote relaxation, reduce anxiety, and strengthen the bond between the woman, her chosen companion, and the healthcare team.[21] Among the most commonly employed techniques are hydrotherapy, massage, breathing exercises, the use of a birthing ball, ambulation, aromatherapy, acupuncture, and guided relaxation.[21,22] In a study by Klein and Gouveia (2022) the majority of women who used non-pharmacological measures experienced vaginal births, echoing the pattern observed in our results.[22] Similar outcomes have been described elsewhere, reinforcing their positive influence on spontaneous delivery and labor progression.[20]

Finally, the absence of clinical and obstetric complications was strongly associated with a lower likelihood of cesarean section.[11] When appropriately indicated, however, cesarean delivery remains a vital intervention to reduce maternal and neonatal mortality in specific, high-risk circumstances such as cord prolapse, placental abruption with a viable fetus, placenta previa, transverse fetal lie, ruptured vasa previa, or active genital herpes.[11,23.] The WHO's *Robson Classification* provides an effective framework to evaluate and compare cesarean rates worldwide.[1] Its implementation enables hospitals to monitor trends and identify priority groups for reducing unnecessary cesarean deliveries.

This retrospective study was based on data extracted from medical records, which may have introduced limitations regarding accuracy and completeness due to reliance on existing documentation. The analysis was limited to women assisted by the Brazilian Unified Health System (SUS), which may restrict the generalizability of the findings to other populations or settings. Variability in record quality and the influence of the COVID-19 pandemic during the study period (2019–2021) may also have affected obstetric practices. Nonetheless, the analysis encompassed a robust sample of 1,485 records and employed rigorous statistical methods, supporting the reliability of the results.

CONCLUSION

The findings demonstrate that cesarean delivery is strongly influenced by multiple obstetric and clinical factors, with primiparous women presenting a significantly higher likelihood of surgical birth. Conversely, advanced cervical dilation, maternal preference for vaginal delivery, amniotomy, oxytocin administration, and the use of non-pharmacological methods were all associated with reduced cesarean rates. The absence of clinical or obstetric complications further acted as a protective factor. These findings reinforce the importance of adopting evidence-based practices and implementing systematic tools such as the *Robson Classification* to evaluate and monitor cesarean trends. Strengthening humanized, woman-centered care within maternity services remains essential to improving maternal and neonatal outcomes.

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